



**Faculty of Science
Chemistry Department**

**Synthesis of Some Terpolymer Nanocomposites and
Their Evaluation as Additives for Some Petroleum
Products**

A Thesis Submitted for the Requirement of Ph.D. Degree

In (Chemistry)

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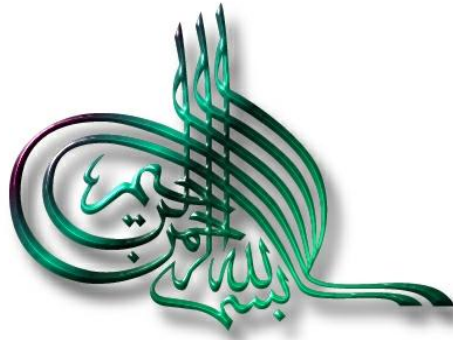
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وَقُلْ اَعْمَلُوا فَسَيَرَى اللَّهُ
عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ

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Aim of the Work

Name: Abeer Abd El Galeel Abd El Mageed Hassan El-Segaey

Title of thesis: Synthesis of Some Terpolymer Nanocomposites and Their Evaluation as Additives for Some Petroleum Products.

This study aims to:

- Preparation of novel terpolymers and terpolymer nanocomposites by reaction between prepared esters/amide with α -olefins and nanoclay (montmorillonite).
- Identification of the chemical structures of the prepared polymers by using several analyses; FT-IR, ^1H NMR, DLS, HR-TEM, EDX, TGA, POM and GPC.
- Evaluation of the prepared polymeric additives as pour point depressants and viscosity indices improvers for petroleum products.
- Determination of rheological properties of petroleum products at different temperatures 25, 45 and 65 °C.
- Determination of tribological properties of lube oil.

LIST of ABBREVIATIONS

Symbols	Description
¹H-NMR	Proton nuclear magnetic resonance
cP	Centipoise
D	Shear-rate
DEME	Diethyl maleate ester
DEME-HDMA-HD (TP₃)	Poly(Diethyl Maleate) –ter- (Hexadecyl Methacrylate Amide) (1-hexadecane)
DEME-HDMA-HD-NMMT (PNC₃)	Nanohybrid of Poly(Diethyl Maleate) –ter- (Hexadecyl Methacrylate amide) (1- hexadecane)
DEME-HDMA-OD (TP₄)	Poly(Diethyl Maleate) –ter- (Hexadecyl Methacrylate Amide) (1-octadecane)
DEME-HDMA-OD-NMMT (PNC₄)	Nanohybrid of Poly(Diethyl Maleate) –ter- (Hexadecyl Methacrylate amide) (1- octadecane)
DEME-HDME-HD (TP₁)	Poly(Diethyl Maleate) –ter- (Hexadecyl Methacrylate Ester) (1-hexadecane)
DEME-HDME-HD-NMMT (PNC₁)	Nanohybrid of Poly(Diethyl Maleate) –ter- (Hexadecyl Methacrylate Ester) (1- hexadecane)
DEME-HDME-OD (TP₂)	Poly(Diethyl Maleate) –ter- (Hexadecyl Methacrylate Ester) (1-octadecane)
DEME-HDME-OD-	Nanohybrid of Poly(Diethyl

NMMT (PNC₂)	Maleate) –ter- (Hexadecyl Methacrylate Ester) (1- octadecane)
DLS	Dynamic Light Scattering
EVA	Eythylenvinylacetate
EVA	Ethylen-vinyl acetate
FTIR	The Fourier transform infrared
GPC	Gel Permeation Chromatography
HD	1- hexadecene
HDMA	Hexadecyl Methacrylate Amide
HDME	Hexadecyl Methacrylate Ester
HRTEM	High-resolution transmission electron microscopy
MMT	Montmorillonite
NMMT	Nanoclay Montmorillonite
NPPD	Nano-hybrid pour point depressant
NPs	Nanoparticles
OD	1-octadecene
OMS	Octadecyl methacrylate, maleic anhydride and styrene terpolymer
POM	Polarizing optical microscopy
PP	Pour point
PPD	Pour point depressant
ppm	Part per million
PTSA	p-Toluenesulfonic acid
T	Shear-stress
T_B	Yield stress
TGA	Thermogravimetric analysis
THF	Tetrahydrofuran

VI	Viscosity index
VII	Viscosity index improver
WAT	Wax Appearance Temperature
η	Apparent viscosity

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